UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
8604 La Jolla Shores Drive
La Jolla, California 92038

February 3, 2003

CRUISE REPORT

VESSELS: NOAA Ships *David Starr Jordan* and *McArthur*

CRUISE NUMBERS: DS-02-07 and AR-02-07
SWFSC Marine Mammal Cruise Numbers 1621 and 1622 respectively

CRUISE DATES: 27 July – 9 December 2002

PROJECT: Hawaiian Islands Cetacean and Ecosystem Assessment Survey (HICEAS)

SPONSOR: NOAA, NMFS, Southwest Fisheries Science Center (SWFSC)
Protected Resources Division (PRD)

Chief Scientist: Dr. Jay Barlow, SWFSC (858) 546-7178

ITINERARY:

Jordan:

LEG 1: Depart: 27 Jul – San Diego, CA	Arrive: 15 Aug - Honolulu, HI
LEG 2: Depart: 23 Aug - Honolulu, HI	Arrive: 07 Sep – Midway, HI
LEG 3: Depart: 10 Sep – Midway, HI	Arrive: 29 Sep – Honolulu, HI
LEG 4: Depart: 05 Oct – Honolulu, HI	Arrive: 24 Oct – Honolulu, HI
LEG 5: Depart: 27 Oct – Honolulu, HI	Arrive: 15 Nov – Honolulu, HI
LEG 6: Depart: 19 Nov – Honolulu, HI	Arrive: 08 Dec – San Diego, CA

McArthur:

LEG 1: Depart: 10 Oct – Coos Bay, OR	Arrive: 04 Nov – Hilo, HI
LEG 2: Depart: 08 Nov – Hilo, HI	Arrive: 26 Nov – Honolulu, HI
Transit: Depart: 30 Nov – Honolulu, HI	Arrive: 09 Dec – San Diego, CA

Cruise Description and Objectives: The HICEAS 2002 cruise was a marine mammal assessment survey of the waters of the Hawaiian Islands. The overall objective of the HICEAS cruise was to estimate the abundance and understand the distribution of dolphins and whales which are found in the waters around the Hawaiian Islands (sighting summary in **Table 1**). In addition, biological and oceanographic data were collected to better characterize the cetacean environment. Other objectives included biopsy sampling, photo-identification, and acoustic study of sounds produced by Hawaiian cetaceans.

STUDY AREA:
Waters of the Hawaiian Island Chain extending off shore to the limits of the U.S. Exclusive Economic Zone (**EEZ**). The survey followed a grid of predetermined tracklines to uniformly cover this offshore area. Actual tracklines covered are shown in **Figure 1**.

1 PROCEDURES FOR DAYLIGHT OPERATIONS

1.1 Cetacean Survey - Line-transect survey methods were used to collect abundance data. At the beginning of each day search effort began on the trackline. The ships travelled at 9-10 knots (through the water) along the designated trackline.

A daily watch for marine mammals was maintained during daylight hours by scientific observers on the flying bridge (approximately 0600 to 1900), except when the ship stopped to conduct other sampling operations, or when precluded by weather. A team of three observers searched with 25x150 binoculars, 7X binoculars, and unaided eye. Sighting conditions, watch effort, sightings, and other required information were entered into a computer, which was patched to the ship's GPS (for course, speed and position information). An "independent observer" occasionally kept a separate watch of animals sighted during the cetacean survey operations, to be compared later with the observer team's data.

1.1.1 Tracklines A grid of tracklines to be covered was established prior to the survey. The actual tracklines covered are shown in **Figure 1**. It was intended that the entire grid of tracklines be covered during the course of the 4-month survey, but the order in which they were covered was determined by weather and other contingencies. If weather precluded survey effort, the Cruise Leader occasionally decided to wait at that position for better weather, or directed the ship to another location on the grid based on weather forecasts. The Cruise Leader was responsible for working with the Command to ensure that the vessel arrived at designated ports at designated times. The Cruise Leader was responsible for coordinating with the Chief Scientist to ensure that the entire survey grid was uniformly covered and that any gaps that were left could be covered efficiently on later legs.

1.1.2 Breaking Trackline - On sighting a marine mammal school or other feature of biological interest, the Cruise Leader or marine mammal observer team on watch requested that the vessel be maneuvered to approach the school or feature for investigation. When the ship approached a group of marine mammals, the observers made independent estimates of school size. Biopsy and photographic operations occasionally commenced from the bow, based on directions from the Cruise Leader or identification specialists. In some instances, the Cruise Leader requested the deployment of a small boat for biopsy, photographic or other operations (see 1.1.6). For sightings of sperm whales, the cruise leader initiated 60 or 90 minute estimates to determine group size, depending on the amount of time available.

It was occasionally necessary to divert the ship's course from the established trackline during regular effort due to glare or adverse sea conditions. Under these circumstances, the ship sometimes diverted up to 30 degrees from the established course. This deviation continued until the ship was 5 nm from the trackline, at which point the ship turned back toward the trackline.

1.1.3 Resuming Effort - When the observers completed scientific operations for the sighting, the ship resumed the same course and speed as prior to the sighting. If the pursuit of the sighting took the ship more than 5 nm from the trackline, the observers were notified. The Cruise Leader or identification specialists sometimes requested that, rather than proceed directly toward the next waypoint, the ship take a heading of 20 degrees back toward the trackline.

1.2 Seabird Survey - Visual surveys of seabirds were conducted from the flying bridge of each ship during daylight hours by a team of two seabird observers who followed a schedule of rotation such that one seabird observer was on effort at all times when weather permitted. The on-effort seabird observer kept a log of sighting conditions, effort, and sightings (see **Table 2**) as required by the project, on a portable computer with a GPS feed from the bridge. Seabird observers occasionally used 25x150 binoculars, but handheld binoculars and unaided eye were the primary modes of searching.

1.3 Conditions Which Precluded Normal Operations – At times during the cruise, visual survey operations were not possible due to high winds, seas, or fog. Usually, survey operations were suspended at Beaufort Sea State 6 or higher. Also, if fog made the visibility one nautical mile or less, visual observations were suspended until visibility increased. During these times, the Cruise Leader decided which task to pursue, if any other operations were possible.

1.4 - Acoustics – Acoustics during this survey included passive listening for marine mammals on *David Starr Jordan*, and active acoustic measurement of backscatter on *David Starr Jordan* and *McArthur*.

1.4.1 – Passive Acoustics Equipment and Procedures - There were three main goals of the acoustic program for the HICEAS 2002 Survey: to determine whether acoustics can add significantly to the estimation of dolphin abundance, to gather additional information on the range of acoustic detection of sperm whales, and to examine vocal characteristics of blackfish and large baleen whales for which genetic information was obtained. To this end, there were two distinct acoustics procedures: continuous monitoring and recording of dolphin and sperm whale vocalizations obtained from a towed hydrophone array and opportunistic deployment of Navy surplus sonobuoys for recording baleen whales.

Two different hydrophone arrays were used, each towed at a distance of 200 m behind the *Jordan* at an approximate depth of 6 m and a speed of 10 knots. The primary array was a 2-element hydrophone array (built in-house) which was used until it was damaged on November 27 (this array is not yet calibrated). Our secondary array was a high frequency 3-element Norris array with sensitivity from 500 Hz to 150 kHz. This array was borrowed from SEFSC, and was used after November 27. A bow hydrophone consisting of three elements was installed on the submersed bow bubble on the Jordan. The bow hydrophone was used for detecting bow riding animals and animals in close proximity to the bow.

Signals received from the array were amplified and monitored by an acoustic technician. Two acoustic technicians rotated on three-hour shifts during daylight hours. Clear cetacean sounds were recorded on a Tascam DA-38 multi-channel recorder and occasionally high frequency vocalizations were recorded directly to the computer hard disk. A record was kept of acoustic effort, comments and five minute acoustic updates using the program WHALTRAK. Real-time visual displays of sounds were monitored using Ishmael software, which also allows for localization of vocalizing animals via beamforming and phone-pair (cross-correlation) algorithms. These angles could then be plotted on the WHALTRAK display and saved to file.

Information regarding sperm whale detections was not shared between visual and acoustic teams until the animals had clearly passed abeam of the vessel; therefore, the visual and acoustic detections of this species can be considered to be independent. Visual observers frequently relayed information about delphinid sightings to the acoustic team to aid them in their documentation of delphinid whistle recordings. The acoustics team would report dolphin schools that had passed the beam within 3 nautical miles if there was an opportunity to chase the animals using localization of the vocalizations. Acoustic chases were made opportunistically, as time allowed.

Sonobuoys were deployed to record cetacean sounds that could not be successfully recorded from the hydrophone array. The focus of these efforts was to obtain recordings of Brydes and sei whales, especially for animals from which genetic samples were obtained. Sonobuoys (type 53) were typically deployed within ½ nmi of a baleen whale that had been sighted by the visual team. Sonobuoy signals were recorded on a DAT recorder and were monitored using a scrolling spectrographic display.

1.4.2 – Passive Acoustic Results – (**Table 3**) A total of 407 sighted cetacean schools were detected and recorded with the acoustic array and bow hydrophone, including dolphin schools, minke whales, and sperm whales. Recordings of visually detected sightings from the towed hydrophone array included vocalizations from common dolphins, striped dolphins, spotted dolphins, spinner dolphins, rough-toothed dolphins, bottlenose dolphins, Fraser's dolphins, Risso's dolphin, melon-headed whales, false killer whales, pilot whales, killer whales, minke whales, and sperm whales (Table 3a). Many of the sighted dolphin schools, and a few of the sperm whale detections, were initially localized by the acoustics team and chased visually to determine species identification. No known acoustic vocalizations from pygmy sperm whales, dwarf sperm whales, tropical bottlenose whales were detected with this equipment. Bowriding bottlenose dolphins, rough-toothed dolphins, and spotted dolphins, as well as nearby minke whales, Blainsvilles' beaked whales, and sperm whales were detected from the bow hydrophone; however, the detection range for this hydrophone was typically less than 500m.

All non-sighted acoustic detections, with the exception of sperm whales and minke whales, were defined as "unidentified dolphins" (Table 3b). There were a total of 309 non-sighted acoustic detections, of which 195 were unidentified dolphins. Sperm whales accounted for 99 of these non-sighted acoustic detections, with most of these detections outside of the search range of the visual observers. The acoustic team detected most of the sperm whales that were seen by the visual team and information regarding animal location was relayed to the visual team according to independent detection protocol (after they passed the beam). In addition, there were a minimum of 15 minke whale "boing" detections, of which at least half were outside of the visual detection range.

A total of 22 type 53 low frequency sonobuoys were deployed from the Jordan (Table 3c). Recordings from a potentially new stock of Brydes whales were recorded, in addition to some of the first recordings of sei whales. A total of 11 of the 22 sonobuoys were functional.

1.4.3 – Active Acoustics – On the *Jordan*, the scientific EK-500 depth sounder was operated by the oceanographer at 38, 120, and 200kHz, to estimate micronekton biomass between 0 and 500 m. We requested that the EK500 run continuously (day and night). The vessel's EQ-50 depth sounder was used at the discretion of the Commanding Officer, but normally remained off while underway, except when navigating in waters less than 100m. The ship informed the Cruise Leader of use of the vessel's EQ-50, as it interferes with the signals received on the EK-500. The scientific EQ-50 was available as a backup for the EK-500, but was not used.

On the McArthur, the scientific EQ-50 was operated by the Chief Survey Technician to estimate micronekton biomass between 0 and 500 m. An acoustic data acquisition system (ADA) collected 38 kHz and 200 kHz acoustic backscatter data from the EQ50 echosounder.

The Acoustic Doppler Current Profiler (ADCP) ran continuously on *Jordan*, and was logged to a data acquisition system. Complete system settings were provided by the oceanographer, but included 5-minute averaging of currents, AGC and 4 beam returns in 60 8-meter bins.

1.5 Small Boat Work - A small boat was often used for biopsy sampling and photography. Deployment was requested by the Cruise Leader on an opportunistic basis, occasionally multiple times in a single day, providing the Commanding Officer concurred that operating conditions were safe. The small boat remained within radar range and radio contact at all times while deployed.

1.5.1 Biopsy Sampling - Biopsies for genetic analyses of marine mammals were collected on an opportunistic basis. Necessary permits were aboard the vessel. The animals sampled were either approached by the research vessel during normal survey operations, or approached the vessel on their own, or were approached by a small boat. Samples were collected from animals within 10m to 30m of the bow of the vessels using a dart fired from a crossbow or a dart rifle. With the exception of the small boat and its requisite safety equipment, all gear was furnished and deployed by the scientific party.

1.5.2 Photography - Photographs of marine mammals were taken on an opportunistic basis. Necessary permits were present on the vessel. The animals photographed were either approached by the research vessel during normal survey operations, approached the vessel on their own, or were approached by a small boat. With the exception of the small boat, all necessary gear was furnished by the scientific party.

1.6 Collection of Fish - Fish were collected on an opportunistic basis at the discretion of the Cruise Leader. While underway, trolling gear was used when conditions permitted and fishing did not interfere with the towed hydrophone array. While stationary, hook-and-line gear was used. Fish were measured, sexed, and stomach contents were examined and recorded by scientific personnel. The Cruise Leader was responsible for the distribution of the catch, in accordance with NOAA Administrative Order 202-735B, dated January 9, 1989.

1.7 Collection of Marine Mammals - Marine mammal body parts, including whale and dolphin ivory and carcasses, were authorized to be collected on an opportunistic basis at the discretion of the Cruise Leader. Permits to collect and import marine mammal parts were present on the vessel.

1.8 Oceanography - Oceanographic sampling was done by the oceanographer (*Jordan*), Chief Survey Technician (*McArthur*), other designated scientists, and a PHS officer (*McArthur*). (See **Table 4** for a summary of environmental data.)

1.8.1 XBT Drops - There were 4 XBT drops per day at 0600, 0900, 1200 and 1500 hours local ship time, and a midnight drop was added for several legs on both ships. If the vessel was stopped at these times, the drop was done once the vessel was again underway. If the vessel was not going to move within half an hour, the drop was delayed or canceled, at the discretion of the Cruise Leader.

1.8.2 Surface Water Samples - A surface water sample for chlorophyll *a* analysis and a bucket temperature was taken at 0600, 0900, 1200, 1500, and 1800 hours local ship time daily.

1.8.3 Thermosalinograph Sampling – Both ships provided and maintained a thermosalinograph (TSG), which was calibrated and in working order, for continuous measurement of surface water temperature and salinity. A backup unit (calibrated and in working order) was also provided by the vessel and remained aboard during the cruise. A data acquisition system (WinDACS), furnished and maintained by scientific personnel, was connected directly to the TSG output from the Seabird interface box, via a cable with a 9-pin female d-sub connection (provided by ship). This computer (laptop) received the raw data, with the NMEA position string attached to each record. Additionally, the laptop was connected to the ship's LAN, in order to synchronize with the ship's time server. The ship's Scientific Computing System (SCS) also collected this information. The oceanographer provided the ship's Operations Officer and Electronics Technician with detailed acquisition information before departure.

2 PROCEDURES FOR NIGHT OPERATIONS

A chronological record of oceanographic and net tow stations was kept by the ship (Electronic Marine Operations Log from *David Starr Jordan*, and a paper version from *McArthur*) with dates and times in GMT. The ships provided a copy of the electronic marine operations log (digital from the *Jordan*) and cruise weather logs to the SWFSC oceanographer at the completion of the cruise. The *Jordan's* main SeaBird CTD system was provided and operated by the scientific party, whereas the *McArthur* provided their whole system. The collection of oceanographic data, samples, and their processing were conducted by the scientific party (*Jordan*) and the Chief Survey Technician and PHS officer (*McArthur*). The crew of the vessel operated all deck equipment and was responsible for the proper termination (and any necessary reterminations) of the CTD cable pigtail (provided by the scientific party on the *Jordan*) to the conducting cable of the winch. Both ships provided a complete backup system, consisting of frame with weights, 12-place rosette and deck unit, and SeaBird 9/11+ CTD with conductivity and temperature sensors. All instruments, their spares and spare parts provided by the ship were required to be maintained in working order and, if applicable, have current calibrations (within previous 12 months). This was not achieved by the McArthur in regards to the ship's salinometer, thus salinity samples were saved and analyzed following the cruise.

2.1 CTD Stations - One CTD (conductivity, temperature, depth) station was occupied each evening, starting a minimum of one hour after sunset, to the nearest 15 minutes. Cast times were subject to change since sunset varied during the cruise. The exact starting time was determined in advance by the Operations Officer, or by the Officer of the Deck. CTD data and seawater samples were collected using a SeaBird 9/11+ CTD with rosette (General Oceanics on the *Jordan* and Seabird on the *McArthur*) and Niskin bottles fitted with silicone tubing and o-rings (supplied by oceanographer). All casts were to 1000m (depth permitting) with the descent rate at 30m/min. for the first 100m of the cast, then 60m/min. after that, including the upcast between bottles.

2.1.1 CTD Samples - Niskin bottle water samples were collected at 12 standard depths between the surface and 1000 meters. From each cast, chlorophyll samples (to 200 m) and salinity samples (500 and 1000 m or bottom) were collected and processed on board. Additional salt samples were collected every other day (4 depths < 500m). The 275 ml chlorophyll samples were filtered onto GF/F filters, placed in 10 ml of 90% acetone, refrigerated for 24 hours, then analyzed on a Turner Designs model 10AU field fluorometer. Salinity samples (used for conductivity cell calibration) were analyzed on a salinometer (Autosal series 8400 by Guildline) provided by each ship. The *Jordan's* salinometer malfunctioned during the first leg, but was repaired several times at sea by the ship's electronics technician to keep the unit operable. Although a spare unit was delivered to the Jordan on Sept. 29th, it was only kept on board as a spare. The *Jordan's* A/C unit in the constant temperature room, where the salinometer was used, failed during the last leg of the cruise, making the salinometer unusable. Fifty-two samples had to be run following the cruise.

The *McArthur's* salinometer was not properly maintained prior to departure and was not used during the cruise. All 113 salinity samples were collected and stored on board. These were analyzed at the SWFSC following the cruise. Nutrient samples (0 - 500 m) were collected, frozen, and stored on board.

2.2 Dipnet sampling - Concurrent with the evening CTD station, dipnetting for surface fauna was conducted by scientific personnel. Samples were preserved, labeled, and stored in the vessel's freezer. Scientists also collected surface fauna for aquaria on board. All live organisms from *McArthur* were donated to the Waikiki Aquarium in Honolulu, and those from *David Starr Jordan* to the Birch Aquarium in San Diego.

2.3 Net Sampling - Net tows were conducted by the scientific party with the assistance of a winch operator from the vessel.

2.3.1 Manta Tow - A surface manta net tow was conducted for fifteen minutes immediately following the CTD station and dipnetting. Average completion time for the entire procedure was
30 minutes. The net was deployed from the starboard hydrowinch. Samples were preserved in formalin, labeled, and stored in containers provided by the SWFSC until the vessel returned to San Diego

2.3.2 Bongo Tow - Bongo nets were towed to a depth of 200m (300 meters of wire out). The bongo tow took place following the Manta Tow each night. The tow lasted approximately 30 minutes. Samples were preserved in formalin, labeled, and stored in containers provided by the SWFSC until the vessel returned to San Diego

2.4 Transit - When scientific operations were complete for the night, the ship resumed course and proceeded along the trackline. The Cruise Leader must have the flexibility to determine the transit speed on a daily basis, depending on planned scientific operations.

SCIENTIFIC PERSONNEL

CHIEF SCIENTIST

The Chief Scientist was Dr. Jay Barlow, SWFSC, at phone (858) 546-7178.

PARTICIPATING SCIENTISTS

Leg 1 (*Jordan*): **Leg 2 (*Jordan*):**

Name	Position	Name	Position
Jay Barlow	Cruise Leader	Eric Archer	Cruise Leader
Richard Rowlett	ID Specialist	Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist	Juan Carlos Salinas	ID Specialist
Jorge A Del Angel	Mammal Observer	Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer	Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer	Cornelia Oedekoven	Mammal Observer
Jennifer N. Latusek	Mammal Observer	Jason Appler	Mammal Observer
Brett Jarrett	Seabird Observer	Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer	Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer	Kerry Kopitsky	Oceanographer
Valerie Philbrick	Oceanographer	Shannon Rankin	Acoustician
Shannon Rankin	Acoustician	Julie Oswald	Acoustician
Allison Walker	Acoustician		Visiting Scientist
Claire Debever	Visiting Scientist		Visiting Scientist

Leg 3 (*Jordan*): **Leg 4 (*Jordan*):**

Name	Position	Name	Position
Sergio Escorza	Cruise Leader	Sarah Mesnick	Cruise Leader
Richard Rowlett	ID Specialist	Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist	Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer	Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer	Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer	Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer	Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer	Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer	Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer	Kerry Kopitsky	Oceanographer
Shannon Rankin	Acoustician	Anne Allen	Asst Oceanographer
Tom Norris	Acoustician	Shannon Rankin	Acoustician
	Visiting Scientist	Jenna Borberg	Acoustician

Leg 5 (*Jordan*): **Leg 6 (*Jordan*):**

Name	Position	Name	Position
Lisa Ballance	Cruise Leader	Bob Pitman	Cruise Leader
Richard Rowlett	ID Specialist	Richard Rowlett	ID Specialist
Juan Carlos Salinas	ID Specialist	Juan Carlos Salinas	ID Specialist
Liz Mitchel	Mammal Observer	Liz Mitchel	Mammal Observer
Erin LaBrecque	Mammal Observer	Erin LaBrecque	Mammal Observer
Cornelia Oedekoven	Mammal Observer	Cornelia Oedekoven	Mammal Observer
Holly Fearnbach	Mammal Observer	Holly Fearnbach	Mammal Observer
Brett Jarrett	Seabird Observer	Brett Jarrett	Seabird Observer
Mike Force	Seabird Observer	Mike Force	Seabird Observer
Kerry Kopitsky	Oceanographer	Kerry Kopitsky	Oceanographer
Shannon Rankin	Acoustician	Shannon Rankin	Acoustician
Tony Martinez	Acoustician	Katie Cramer	Acoustician
Bob Pitman	Asst Oceanographer		Visiting Scientist

Leg 1 (*McArthur*): **Leg 2 & 3 (*McArthur*):**

Name	Position	Name	Position
Karin Forney	Cruise Leader	Tim Gerrodette	Cruise Leader
Jim Cotton	ID Specialist	Jim Cotton	ID Specialist
Jorge A Del Angel	ID Specialist	Jorge A Del Angel	ID Specialist
Susanne Yin	Mammal Observer	Susanne Yin	Mammal Observer
Isabel Beasley	Mammal Observer	Isabel Beasley	Mammal Observer
Susan Rickards	Mammal Observer	Susan Rickards	Mammal Observer
Candice Emmons	Mammal Observer	Candice Emmons	Mammal Observer
Dawn Breese	Seabird Observer	Dawn Breese	Seabird Observer
Sophie Webb	Seabird Observer	Sophie Webb	Seabird Observer
Sam DuFresne	Oceanographer		Oceanographer

DISPOSITION OF DATA:

The mammal sighting, acoustic, and oceanographic data are currently being analyzed. The final reports will be completed by February 2004.

All original marine mammal files and records were delivered to the Chief Scientist, Dr. Jay Barlow, SWFSC. Passive acoustic data are stored, for analysis and archive at SWFSC with the Chief Scientist.

Acoustic backscatter data were delivered to Dr. David Demer, SWFSC for analysis and distribution.

Oceanographic data were delivered to Dr. Paul Fiedler, SWFSC for analysis and distribution.

Biopsy samples were delivered to Dr. Kelly Robertson, SWFSC for analysis and distribution.

Seabird files were delivered to Dr. Lisa Ballance, SWFSC for analysis and distribution.

Prepared by: ______________________ Dated: 26 FEB '03
LTjg Jason Appler
Survey Coordinator, SWFSC

______________________ Dated: 26 Feb '03
Dr. Jay Barlow
Chief Scientist, SWFSC

Approved by: Michael A. Tillman Dated: 2/26/03
Dr. Michael Tillman,
Science Director, F/SWR

Signature Not Verified

Survey Coordinator

Digitally signed by Survey Coordinator
DN: cn=Survey Coordinator, o=NOAA/NMFS, ou=SWFSC, c=US
Date: 2003.03.03 10:30:50 -08'00'

Table 1:
Summary of Marine Mammal School Sightings

Code	Species Name	No. of Schools Sighted Pure	Mixed	Total	Average School Size
2	*Stenella attenuata* (offshore)	16	0	16	38.3
5	*Delphinus* sp.	10	0	10	20.2
13	*Stenella coeruleoalba*	20	1	21	17.6
15	Steno *bredanensis*	11	8	19	7.2
17	*Delphinus delphis*	21	1	22	32.8
18	Tursiops *truncatus*	10	11	21	7.9
21	*Grampus griseus*	5	6	11	10.1
26	*Lagenodelphis hosei*	1	1	2	88.6
31	*Peponocephala electra*	0	1	1	40.5
32	*Feresa attenuata*	3	0	3	5.2
33	*Pseudorca crassidens*	2	1	3	3.2
36	*Globicephala macrorhynchus*	20	12	32	9.3
37	*Orcinus orca*	2	0	2	2.1
46	*Physeter macrocephalus*	60	0	60	2.1
47	*Kogia* breviceps	2	0	2	1
48	*Kogia sima*	5	0	5	1.7
49	*ziphiid whale*	11	0	11	2.1
51	*Mesoplodon* sp.	4	0	4	6.3
59	*Mesoplodon densirostris*	3	0	3	1.6
61	*Ziphius cavirostris*	11	0	11	1.6
65	*Indopacetus pacificus*	1	0	1	4.4
70	*Balaenoptera* sp.	6	0	6	1
71	*Balaenoptera acutorostrata*	1	0	1	1
72	*Balaenoptera edeni*	18	0	18	1.1
73	*Balaenoptera borealis*	8	0	8	1.1
74	*Balaenoptera physalus*	7	1	8	1.2
75	*Balaenoptera musculus*	12	0	12	1.1
76	*Megaptera* novaeangliae	2	0	2	1
77	unid. dolphin	21	1	22	6.4
78	unid. small whale	10	0	10	1.4
79	unid. large whale	9	0	9	1
80	*Kogia* sp.	1	0	1	2
96	unid. cetacean	5	0	5	1.6
98	unid. whale	8	0	8	1.4
99	*Balaenoptera borealis/edeni*	3	1	4	1.2
102	*Stenella longirostris* (Gray's)	10	0	10	9.4
177	unid. small delphinid	30	1	31	9.3

Table 2a:
Seabirds sighted during HICEAS aboard the *David Starr Jordan*.

Common name	Scientific name	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Leg 6	Total
Albatrosses	Diomedeidae	12	0	0	5	3	37	57
Tubenoses	Procellariidae							
Shearwaters	*Puffinus* spp.	695	429	3101	1443	1281	148	7097
Petrels	*Pterodroma* spp., *Fulmarus* spp.	212	583	700	664	209	60	2428
Storm-petrels	Oceanitidae	111	5	10	33	47	96	302
Tropicbirds	Phaethontidae	34	45	61	23	15	29	207
Boobies	Sulidae	16	73	89	100	55	36	369
Frigatebirds	Fregatidae	12	7	9	17	16	12	73
Phalaropes	Phalaropodidae	46	0	0	0	0	26	72
Jaegers	Stercorariidae	6	12	16	8	5	4	51
Gulls	*Larus* spp.	2	0	0	0	0	10	12
Terns	*Sterna* spp., *Gygis* sp., *Chlidonias* spp., *Anous spp.*	112	695	695	95	115	94	1806
Auks	Alcidae	14	0	0	0	0	0	14
	Total	1272	1849	4681	2388	1746	552	12488

Table 2b:
Seabirds sighted during HICEAS aboard the *McArthur*.

Common name	Scientific name	Leg 1	Leg 2	Leg 3	Total
Albatrosses	Diomedeidae	17	809	27	853
Tubenoses	Procellariidae				
Shearwaters	*Puffinus* spp.	756	2594	23	3373
Petrels	*Pterodroma* spp., *Fulmarus* spp.	468	354	20	842
Storm-petrels	Oceanitidae	28	48	52	128
Tropicbirds	Phaethontidae	37	9	16	62
Boobies	Sulidae	22	208	9	239
Frigatebirds	Fregatidae	8	5	0	13
Phalaropes	Phalaropodidae	9	0	82	91
Jaegers	Stercorariidae	9	0	8	17
Gulls	*Larus* spp.	7	0	6	13
Terns	*Sterna* spp., *Gygis* sp., *Chlidonias* spp., *Anous spp.*	383	42	5	430
Auks	Alcidae	6	0	1	7
	Total	1750	4069	249	6068

Table 3a: Number of sighted cetacean schools per leg for which acoustic recordings were obtained using a towed hydrophone array or bow hydrophone on the *Jordan* during HICEAS 2002, listed in order of the number of recordings obtained. This includes recordings of mixed species schools. The "*" indicates an inconclusive sighting identification of an unidentified small whale; however, acoustic recordings indicate that this was a *B. acutorostrata.*

Species	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Leg 6	Total
Physeter macrocephalus	0	9	4	12	4	14	43
Stenella coeruleoalba	3	2	4	4	2	1	16
Unidentified dolphins	3	0	1	4	0	6	14
Globicephela spp.	3	1	1	4	2	3	14
Steno bredanensis	1	0	1	5	0	2	9
Delphinus delphis	6	0	0	0	0	1	7
Tursiops truncatus	0	2	2	0	0	2	6
Grampus griseus	1	0	0	1	2	2	6
Stenella attenuata	0	2	0	2	0	2	6
Stenella longirostris	1	1	0	1	0	0	3
Psuedorca crassidens	0	1	1	0	0	0	2
Balaenoptera acutorostrata	0	0	0	0	1	1*	2
Lagenodelphis hosei	0	0	0	0	1	0	1
Peponocephala electra	0	0	0	0	1	0	1
Orcinus orca	0	0	1	0	0	0	1
Mesoplodon densirostris	0	0	0	1	0	0	1
Total	55	53	43	99	87	70	407

Table 3b: Number of non-sighted cetacean schools per leg for which acoustic recordings were obtained using a towed hydrophone array on the *Jordan* during HICEAS 2002, listed in order of the number of recordings obtained

Species	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Leg 6	Total
Unidentified dolphins	29	20	18	39	54	35	195
Physeter macrocephalus	8	15	10	26	18	22	99
Balaenoptera acutorostrata	0	0	0	0	2	13	15
Total	37	35	28	65	74	70	309

Table 3c: Number of cetacean recordings obtained using sonobouys on the *Jordan*. A total of 22 sonobuoys were launched, of which 11 were functional.

Species	Vocals	No Vocals
Balaenoptera edeni	3	4
Balaenoptera borealis	2	1
Balaenoptera physalus	0	1
Total	5	6

Table 4a: Summary of environmental data collected during the 2002 HICEAS survey aboard the NOAA Ship *David Starr Jordan*.

	LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	TOTALS
CTD casts	14	12	17	18	15	14	90
CTD chlorophyll samples	130	110	170	190	149	140	889
Surface chlorophyll	87	77	95	87	74	83	503
Nutrient samples	154	132	187	209	165	154	1001
Salinity samples	64	44	84	78	74	48	392
XBT drops	89	86	89	90	73	85	512
Bongo Tows	13	12	14	17	15	8	79
Manta Tows	13	12	15	17	15	8	80

Table 4b: Summary of environmental data collected during the 2002 HICEAS survey aboard the NOAA Ship *McArthur*.

	LEG 1	LEG 2	LEG 3	TOTALS
CTD casts	17	14	4	35
CTD chlorophyll samples	156	140	40	336
Surface chlorophyll	116	75	33	224
Nutrient samples	159	143	44	346
Salinity samples	54	47	12	113
XBT drops	100	60	46	206
Bongo Tows	12	12	0	24
Manta Tows	18	12	0	30

Table 5:
Days Lost to Mechanical Breakdowns

Date of Incident	Days Lost	Nature of Incident
19 August	4 (DSJ)	Fleet Inspection problems and Engine Room monitoring computer
Total	4	

Table 6:
Days Lost to Weather – (Less than 20 nm of usable search effort)

Date	DSJ Leg
05 Oct	4
10 Nov	5
11 Nov	5
2 Dec	6
3 Dec	6
Total = 5 days	

Date	AR Leg
15 Oct	1
16 Oct	1
17 Oct	1
18 Oct	1
23 Oct	1
29 Oct	1
14 Nov	2
Total = 7 days	

Figure1: Actual Trackline Coverage